

# NASA TECH BRIEF



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## Computer Program Calculates Wing Aerodynamic Characteristics for Fixed Wings with Dihedral and Variable-Sweep Wings at Subsonic Speeds

This program uses a vortex lattice to describe the lifting surface of an arbitrary wing planform in steady potential subsonic compressible flow. The following aerodynamic characteristics are computed:  $C_{L_a}$ ,  $C_L$  at  $\alpha=0$ , at  $C_L=0$ ,  $Y_{cp}$ ,  $\partial C_m / \partial C_L$ ,  $C_{m_0}$ ,  $C_{D_i} / C^2_L$ , spanwise distribution of additional wing loading, spanwise distribution of wing loading due to twist and camber, spanwise distribution of basic wing loading, and spanwise distribution of wing loading at a specific lift coefficient combining basic and additional loading. Punched card output is also provided for use as input to a computer program which estimates the flow field characteristics in the vicinity of a lifting wing at subsonic speeds.

The procedure used in this program is divided into three parts. The first part computes the geometry required to represent the wing planform by a system of horseshoe vortices and is divided into three sections. In the first section, group one of the input data (a description of the wing planform) is read and checked by the program. The second section reads group two of the input data and defines the configuration details. Section three defines the horseshoe vortex lattice.

In the second part of the program, the influence functions for the downwash and sidewash velocities at the control point of each horseshoe vortex are computed; the matrix constant terms are computed; and the matrix is solved for values which are proportional

to circulation. The matrix is solved twice; the first solution uses the matrix constant terms based on the local angle of attack caused by twist and/or camber on the wing and the second solution uses the matrix constant terms for one radian angle of attack and no twist or camber. This results in two sets of circulation terms; one for twist and camber surface loading and one for additional surface loading.

The third part of the program uses the circulation terms ( $\Gamma_n/U$ ) to compute the lift and pitching-moment data for wings with dihedral; a simplified procedure is used for zero dihedral wings. Then for both situations the final form of the output data is computed and printed.

### Notes:

1. This program is written in CDC Fortran, version 2.0 for the CDC 6000 Series Computer with the Scope 2.0 operating system and library tape.
2. Inquiries concerning this program may be made to:  
COSMIC  
Computer Center  
University of Georgia  
Athens, Georgia 30601  
Reference: B67-10666

### Patent status:

No patent action is contemplated by NASA.

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